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Performance Comparison and Visualization of COMSOL Multiphysics, Matlab, and Fortran for Predicting the Reservoir Pressure on Oil Production in a Multiple Leases Reservoir with Boundary Element Method

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Abstract : This paper presents the performance comparison of some computation software for solving the boundary element method (BEM). BEM formulation is the numerical technique and high potential for solving the advance mathematical modeling to predict the production of oil well in arbitrarily shaped based on multiple leases reservoir. The limitation of data validation for ensuring that a program meets the accuracy of the mathematical modeling is considered as the research motivation of this paper. Thus, based on this limitation, there are three steps involved to validate the accuracy of the oil production simulation process. In the first step, identify the mathematical modeling based on partial differential equation (PDE) with Poisson-elliptic type to perform the BEM discretization. In the second step, implement the simulation of the 2D BEM discretization using COMSOL Multiphysic and MATLAB programming languages. In the last step, analyze the numerical performance indicators for both programming languages by using the validation of Fortran programming. The performance comparisons of numerical analysis are investigated in terms of percentage error, comparison graph and 2D visualization of pressure on oil production of multiple leases reservoir. According to the performance comparison, the structured programming in Fortran programming is the alternative software for implementing the accurate numerical simulation of BEM. As a conclusion, high-level language for numerical computation and numerical performance evaluation are satisfied to prove that Fortran is well suited for capturing the visualization of the production of oil well in arbitrarily shaped.

Keywords : performance comparison, 2D visualization, COMSOL multiphysic, MATLAB, Fortran, modelling and simulation, boundary element method, reservoir pressure
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